

1086 North Broadway
Yonkers, New York 10701
June 20, 1967

Mr. A. W. Hook
Anaconda Aluminum Company
Columbia Falls, Montana

Dear Warren:

I saw no overt symptoms of fluorosis on vegetation during my trip to Columbia Falls and tour of the Plant site. However, it would be advisable for Anaconda Aluminum to engage in a continual survey of vegetation in the area around the Plant during the entire growing season. I recommend this for two reasons. First, I was at Columbia Falls at the beginning of the growing season, and it is possible that symptoms may develop later since fluoride is cumulative in its effects. Second, some of the statements and attitudes that were expressed at the hearings in Helena indicate that industry may be assumed to be guilty until proven innocent.

I cannot give specific details as to the type of survey that should be made since I do not know the manpower and budget limitations you must work with. I will outline below the general considerations and objectives that should be a part of any program.

First, the inspection of vegetation for visible symptoms must be accompanied by the determination of fluoride in the foliage. Several other factors, such as water stress in conifers or nutrient deficiency in other plants can resemble fluorosis. Moreover, Dr. Hindawi from the Abatement Branch of the National Center for Air Pollution Control stated that fluoride analyses are the only sure means of determining if fluoride is responsible for visible injury on vegetation.

Second, the distribution of visible injury on a single tree, the variability between trees of the same species at the same location, and the distribution of symptoms in the entire area are important. The expanding needles of conifers and the younger leaves of other plants are much more sensitive to fluoride than the more mature foliage. In addition, conifers (except for larch) will retain their needles, and this year's needles will be the surest indicators of the present situation. Plants vary in sensitivity to fluoride, but a comparison of several trees in one area will give some indication as to whether some general or specific factor is responsible for the observed symptoms. The pattern of symptoms can be compared with the patterns obtained by foliar fluoride analysis and air monitoring to determine if some relation exists among the three in the area around the Plant site.

Third, the following table is adapted from an article by Moyer Thomas in the WHO publication on air pollution.

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Class 1 (most sensitive to injury by HF)

Larch
Ponderosa pine (young needles)

Class 2

Douglas fir
Ponderosa pine (3-4-month-old needles)

Class 5

Lodgepole pine
Ponderosa pine (old needles)

Class 6 (least sensitive)

Hemlock
Western White pine
Engelmann spruce

Thus it is important that at any location at least two different species should be observed. I think that the conifers, such as Western larch, Ponderosa pine, and Lodgepole pine, would be the best since they appear to be abundantly distributed in the area and they can be most easily identified and observed in the field. The above differences in fluoride-sensitivity could then be compared with what is observed.

Fourth, the scope and frequency of the surveys are up to you. Perhaps three times during the growing season would be sufficient.

Fifth, these survey procedures are suggested only to give you some information as to what your possible situation may be and to aid you in your air monitoring program. They would be in-house data and not something that could be called expert opinion as to the situation.

If I have been ambiguous or brief or if questions of yours are still unanswered, please let me know, and I shall be glad to supply any information that I can.

I am also enclosing a statement of expenses covering my trip to Columbia Falls and the hearings in Helena.

Very truly yours,

D. C. McCune

lp
enc.